Claims

1) An electric motor monitoring system comprising an antenna, a data sampling means and a data processing means wherein the electric motor monitoring system provides a diagnostic for monitoring the operation of both mechanical and electrical components of the electric motor.

2) An electric motor monitoring system as claimed in Claim 1 wherein the antenna provides a means for detecting high frequency signals generated by arcing events within the electric motor.

3) An electric motor monitoring system as claimed in Claim 1 or Claim 2 wherein the antenna comprises a means for screening background noise so improving the overall signal to noise ratio of the electric motor monitoring system.

4) An electric motor monitoring system as claimed in any of the preceding claims wherein the antenna further comprises a frequency matching unit such that the frequency matching unit allows the antenna to be frequency tuned so as to optimise its operation with the electric motor.

5) An electric motor monitoring system as claimed in Claim 4 wherein the frequency matching unit comprises a signal conditioning unit.

6) An electric motor monitoring system as claimed in any of the preceding Claims wherein the antenna comprises a balanced Faraday screened loop antenna.

7) An electric motor monitoring system as claimed in claim 1 to 5 wherein the antenna comprises an unbalanced Faraday screened loop antenna.

8) An electric motor monitoring system as claimed in any of the preceding Claims wherein the antenna comprises an electric field probe or a magnetic field probe.

9) An electric motor monitoring system as claimed in any of the preceding Claims wherein the data sampling means comprises an anti aliasing filter, an analogue to digital converter and a high speed PCI card such the data sampling means allows the high frequency signal, over a predetermined length of time, to be captured.

10) An electric motor monitoring system as claimed in Claim 9 wherein the data processing means further comprises a computer processor capable of manipulating and storing the captured data.

11) An antenna for measuring high frequency signals associated with arcing events in an electric motor, comprising a loop and a loop screen, wherein the loop screen shields the loop from background noise thus improving the signal to noise ratio of the signal detected by the antenna.

12) An antenna as claimed in Claim 11 wherein the loop screen physically covers all but a small detection section of the loop.

13) An antenna as claimed in Claim 11 or 12 wherein the antenna further comprises a frequency matching unit such that the frequency matching unit allows the antenna to be frequency tuned so as to optimise the antenna's operation with the electric motor.

14) An antenna as claimed in Claim 13 wherein the frequency matching unit comprises a signal conditioning unit.

15) An antenna as claimed in Claims 11 to 14 wherein the loop comprises a conductor and a screened coaxial cable such that the conductor is turned back on itself so as to form one or more turns while the end of the conductor cable is attached to the screen of the coaxial cable.

16) A diagnostic method for monitoring the operation of both mechanical and electrical components associated with an electric motor comprising:
    1) Detection of high frequency signals associated with arcing events within the electric motor;
    2) Sampling the high frequency signal over a predetermined length of time;
    3) Processing the sampled data so as to provide information regarding the mechanical and electrical components of the electric motor.

17) A diagnostic method according to Claim 16 wherein the method provides a means for associating the frequency of the high frequency signal to individual components of the electric motor.

18) A diagnostic method according to Claims 16 or 17 wherein the detection of the high frequency signals employs a non-intrusive antenna.

19) A diagnostic method according to Claims 16 to 18 wherein the sampling provides a means for monitoring frequency modulation and amplitude modulation within the high frequency signals.

20) A diagnostic method according to Claims 16 to 19 wherein the processing of the sampled data comprises Fast Fourier Transformations applied to the sampled data so as to convert the sampled data to interpretable frequency spectra.

21) A diagnostic method according to Claims 16 to 19 wherein the processing of the sampled data comprises Wavelet Analyses or some other Digital Signal Processing technique applied to the sampled data so as to convert the sampled data to interpretable frequency spectra.

22) A diagnostic method according to Claims 20 or 21 wherein the interpretable frequency spectra comprise frequency features that can be directly associated with particular diagnostics of the mechanical or electrical components of the electric motor.

23) A diagnostic method according to Claims 20 to 22 wherein the interpretable frequency spectra comprise frequency features that can be directly associated with particular mechanical or electrical faults of the electric motor.

24) A diagnostic method according to Claims 16 to 19 wherein the processing of the sampled data comprises calculating an average width of the high frequency signals, above a predetermined level, over a number of arcing events.

25) A diagnostic method according to Claims 16 to 19 wherein the processing of the sampled data comprises calculating an average height of the high frequency signals over a number of arcing events.

26) A diagnostic method according to Claims 16 to 19 wherein the processing of the sampled data comprises calculating an average ratio of the width and height of the high frequency signals over a number of arcing events.

27) A diagnostic method according to Claims 16 to 26 wherein the method comprises a step of self calibration of the diagnostic method.

28) A diagnostic method according to Claim 27 wherein the self calibration of the diagnostic method comprises a current measuring technique involving the steps of:

1) Measuring the torque on the electric motor by employing the non-intrusive antenna;

2) Measuring directly the current in the electric motor so as to enable the torque on the electric motor to be calculated;
3) Taking the difference between the two methods for obtaining the value of the torque on the electric motor so providing a compensation factor; and
4) Adding the compensation factor to the non-intrusive antenna method for measuring the torque on the electric motor.